B.Sc. 3rd Semester (Honours) Examination, 2023 (CBCS)

Subject : Physics

Course : CC-VII

(Digital Systems and Application)

Time: 2 Hours

Full Marks: 40

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words
as far as practicable.

Group-A

1. Answer *any five* of the following questions: 2×5=10

   (a) What is meant by nibble and byte? What is the largest decimal value that can be represented by a eight bit binary number?

   (b) How –9 can be represented using eight bits in signed magnitude representation and signed two's complement representation?

   (c) The sum of 22 and 2 in a number system, whose base is unknown, is 10 in decimal number system. Find the base of the unknown number system.

   (d) Prove $(X + Y)(\overline{X} + Z)(Y + Z) = XZ + Y\overline{X}$.

   (e) Given $f(A, B, C, D) = \Sigma m(3,4,6,7,12,14)$; Lay a Karnaugh map and obtain the simplified Boolean expression.

   (f) If the deflection sensitivity of a cathode ray tube is 0.01 mm/V, calculate the shift produced in the spot when 300 V is applied to the vertical plates.

   (g) For a negative edge triggered J-K flip-flop, draw the output waveform with the change of input conditions along with the clock pulse.

   (h) MOV A,B : what does this instruction mean in case of intel 8085 microprocessor? The binary form of opcode of this instruction is 01111000. How does this code represent the said instruction?

Group-B

Answer *any two* of the following questions.   5×2=10

2. A staircase light is controlled by two switches, one at the top of the stairs and another at the bottom of the stairs. Make a truth table for the system. Write logic equation in SOP form. Realize the circuit using basic gates. Realize the circuit using NAND gates only.   0.5+0.5+1+3

3. A and B are single bit binary numbers. How can you test whether A is less than B, A is greater than B, A is equal to B? Write down the Boolean expressions and truth table for the three cases mentioned above and draw the combinational logic design of the same.   1+1+1+2

4. You are asked to add three single bit binary numbers at a time. Lay the truth table for the process. Write the necessary Boolean expressions with possible simplification and draw NAND only combinational logic designs to realize it.   0.5+0.5+0.5+3.5

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5. What is meant by the modulus of a counter? To design a four bit decade counter, how many flip-flops are required? Explain the operation of a ripple counter which can count decimal zero to seven. Draw the output wave forms with clock pulse.   1+0.5+2+1.5

Group-C

Answer *any two* of the following questions.   10×2=20

6. (a) Draw the schematic diagram of a cathode ray tube clearly labelling its components. Derive the magnetic deflection sensitivity of the same.

   (b) In a CRT two deflecting plates are of length 3cm each and are separated by 1cm. The distance of the screen from the center of the deflecting plates is 20cm. If the accelerating anode potential is 1000 volts, find out the deflection sensitivity. Calculate the peak voltage of the sinusoidal voltage applied to the plates if it gives 5cm straight line trace on the screen.   (2+4)+4

7. What is meant by sequential circuit? What is the basic building block of a sequential circuit? Draw the logic circuit of a system which can store one bit of information in it and explain its operation. How this basic one bit storage system be converted to an S-R flip-flop? Explain with truth table. In case of a synchronous S-R flip-flop, what is the function of asynchronous inputs namely PRESET and CLEAR? How a D type flip-flop be designed from the S-R flip-flop?   1.5+1+1.5+3+2+1

8. Make a K-Map for the function $f = \overline{B} + A\overline{C} + \overline{A}CD$. Express f in standard SOP form. Given $Y = AB\overline{C} + \overline{A}\overline{B}\overline{C} + \overline{A}BC + AB\overline{C}$, make a truth table. From it write output Boolean expression involving maxterms. Realize it using NOR gates only.   2+2+1.5+2+2.5

9. Write down the names of different components of a microprocessor. What is the data bus and address bus width in terms of bits in Intel 8085 microprocessor? What is meant by microprocessor-memory interface? Explain with block diagram. How many memory locations can be addressed by 8085 address bus? Draw block diagram of interfacing input-output devices with microprocessor. What will be the instruction for the task "the data in hex-code move immediate to register *r*"?   2+1+3+1+2+1